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Abstract: Civil conflicts devastate public health both in the short run and in the long run. Analyzing novel data sets that include yearly information on public health and the availability of health professionals across provinces in Turkey in the 1964-2010 period, we provide empirical evidence for our theoretical argument that a major mechanism through which civil conflicts exert their long term negative influences on public health is by discouraging medical personnel to practice in conflict regions. We also assess the effectiveness of certain policy measures that Turkish governments have tried out over the years to counteract this mechanism. Our results reveal that the long running civil conflict in Turkey has been driving away doctors and other highly trained medical personnel from conflict areas and that mandatory service requirements do help counteract this flight.

1. INTRODUCTION

Civil conflicts have both immediate and long-term effects on social well-being. There is the immediate suffering in the form of casualties, displacements, the destruction of infrastructure and property. And a recently emerging literature is telling us that the indirect and longer term impacts on health (Davis and Kuritsky, 2002; Guha-Sapir and Van Panhuis, 2003; Hoeffler and Reynal-Querol; 2003; Li and Wen, 2005; De Walque and Filmer, 2012; Akresh et al.,2009), education (for a detailed review see Kıbrıs, 2015), economic activity (Collier et al., 2003; Collier, 1999), and social cohesion and trust (Kıbrıs, 2014; Wood, 2008; Sambanis and Shayo, 2013) are even more substantial. Nonetheless, Blattman and Miguel (2010) argue in their detailed review of this literature that we are still far from a complete understanding of the damages civil conflicts inflict upon societies. The important question is not whether these conflicts harm societies, but rather in what ways, how much, and how persistently—all crucial questions for understanding the impacts on economic, political and social development, as well as priorities for post-conflict assistance.

This study contributes to the literature that addresses these crucial questions. By analyzing novel data sets from Turkey, we provide empirical evidence for yet another negative consequence of civil conflicts. We show that the enduring civil conflict in Turkey has been driving away medical personnel from conflict areas. This is an important, yet academically neglected mechanism through which civil conflicts exert their long-term negative influences on public health. We also assess the effectiveness of certain policy measures that Turkish governments used to intervene in the medical labor market to offset the disparity between the conflict zone and other parts of the country. While our results indicate that higher salaries do not increase medical personnel counts, mandatory service requirements are associated with higher number of doctors

It is well established that civil conflicts inflict long term damage to public health. The ebola outbreak in sub-saharan Africa constitutes the latest example. Of the 32 sub-Saharan African states to have experienced internal armed conflict since 1976, nearly a third have also experienced ebola

outbreaks. In fact, the virus appears to be tracking ongoing and recent civil wars in the Democratic Republic of Congo (1976), Gabon (1996), Uganda (2000), Gabon again (2001), Congo (2002) to today's outbreak in West Africa (Fazal, 2014; Maxman, 2014). What we need at this point is to develop a thorough understanding of the mechanisms through which civil conflicts damage public health so that we can devise effective counteractive policies. We argue that the flight of medical personnel is one such mechanism which, despite its importance, has not received much scholarly attention. While there are studies which have theoretically acknowledged the existence of such a mechanism, to our knowledge, this is the first study to provide empirical evidence of the flight of health professionals from conflict areas. The main reason why the issue has been left unexplored is the lack of data. Information systems that record the indicators of social well-being often cease to function in societies experiencing civil conflict. It is also common that officials refuse to share information in an effort to hide the true extent of the damage caused by the conflict. Consequently, data on the availability of medical personnel across locations and time is hard to come by for countries with civil conflicts.

The second major contribution of our study is the provision of such data for Turkey. Through extensive research on Turkish State Archives, we have constructed a novel data set that includes yearly information on the number of doctors, nurses, dentists, midwives, and health technicians across provinces in Turkey between 1964 and 2010, along with some important public health indicators. This time-series-cross-section panel, which spans an impressive 46-year period, enables us to analyze whether the Kurdish-Turkish armed conflict that has been going on since 1984 has had an impact on the supply of medical professionals in conflict areas. The results reveal a significant negative impact. We then look into the role medical personnel play in public health. Finally, we analyze two different policies employed by the Turkish governments over the years, and investigate whether those policies proved effective in halting the flight of the medical personnel out

from the conflict areas and in improving public health. We believe this exercise provides important clues for developing effective counteractive policies.

2. PUBLIC HEALTH AND CIVIL CONFLICTS

Civil conflicts damage the ability of civilians to lead a long, and healthy life (Ghobarah, Huth and Russett, 2003; Iqbal, 2006) resulting in a persistent increase in mortality rates (Guha-Sapir and Van Panhuis, 2003; Hoeffler and Reynal-Querol, 2003; Li and Wen, 2005; De Walque and Filmer, 2012). Previous research suggests that a significant portion of this increase results from an increased spread of infectious diseases (Degomme and Guha-Sapir, 2010). Berrang-Ford, Lundine and Brau (2011), for example, associate the reemergence of the Human African Trypanosomiasis disease in sub-Saharan Africa with the armed conflicts in the region. Akresh et al. (2009) reveal the stunting effect of the civil conflict on the physical development of children in Rwanda. Davis and Kuritsky (2002) show that in sub-Saharan Africa, countries which have experienced violent conflict have significantly worse health indicators compared to peaceful countries.

Despite the ample evidence on the detrimental impacts of civil conflicts on public health we still lack a complete understanding of the mechanisms behind these impacts to formulate effective policies to counteract the damage. Existing works offer theoretical discussions on what these mechanisms might be, but they do not empirically analyze those mechanisms nor the extent of the damage caused by them. One very comprehensive theoretical discussion is offered by Ghobarah, Huth, and Russett (2003; 2004). They identify five major mechanisms: (1) The destruction of infrastructure such as hospitals, roads, water supply, and power grids; (2) The increased risk of exposure to diseases due to displacement of large populations and poor conditions in refugee camps; (3) The lack of financial resources due to economic hardship; (4) The diversion of existing resources to military use leading to resource scarcity in the health sector; (5) The flight of medical

professionals from conflict areas. Iqbal (2006) adds to this list the disruptions in agricultural production which may then lead to widespread famines.

In this study, we focus on the flight of medical personnel from conflict areas, and provide empirical evidence from the Turkish case. We then analyze two specific policies that Turkish governments implemented in order to halt this flight. We believe our work provides important clues for devising effective policies to counteract the negative impacts of civil conflicts on public health.

3. THE TURKISH CASE

3.1 The Civil Conflict

Since late 1984, Turkey is experiencing an insurgency campaign led by the Kurdish separatist guerrilla organization Kurdistan Workers' Party (Partiya Karkaren Kurdistan), the PKK. The PKK was first founded with the goal of establishing an independent Kurdish state in southeastern Turkey, though later on in the 1990s, it appeared to have aimed for a federal structure that would grant more autonomy to the large Kurdish minority in Turkey. The armed activities of the PKK have been almost completely concentrated in Southeastern and Eastern Turkey which is a poor, and underdeveloped part of the country, and which has traditionally been inhabited by ethnic Kurds.

Financially, the conflict has cost the country billions of dollars. But more importantly, it has cost more than 40 thousand lives (Şener, 2010). Our knowledge about civilian and insurgent casualties is limited to aggregate numbers sporadically released by contending sources. Nevertheless, Kıbrıs (2011; 2015; 2014) offers a unique database on security force (i.e., soldiers and police officers) casualties (SFCs).

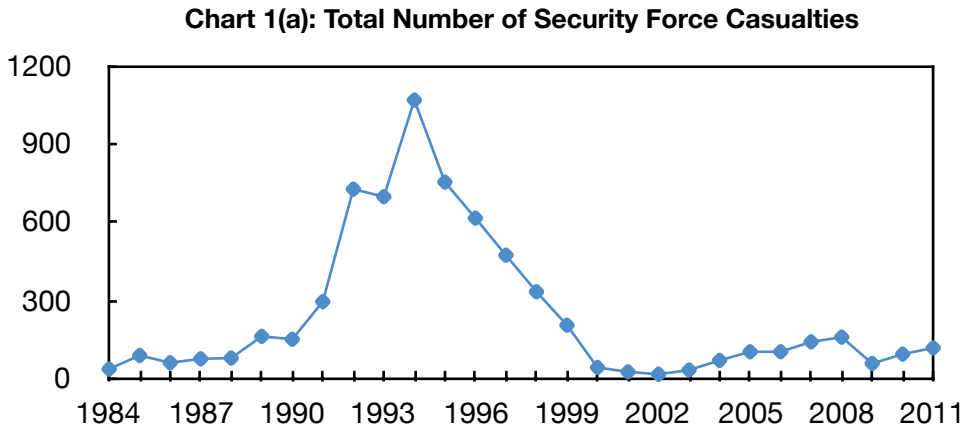


Chart 1(a) depicts the total number of SFCs over the years, and Chart 1(b) presents their geographical distribution. As can be seen in Chart 1(a), the 90s has been the most bloody period of the conflict. The PKK received a major setback when its leader Abdullah Öcalan was captured in Africa in 1999, brought back to Turkey, tried and sentenced to life in prison. Due in part to this lack of leadership, the PKK ceased its attacks in the early 2000s. Unfortunately, peace in the area did not last long. The PKK resumed its attacks in 2004 and continued up until the latest cease fire in March 2013. The destructiveness of the conflict resulted in the deepening of the economic and social

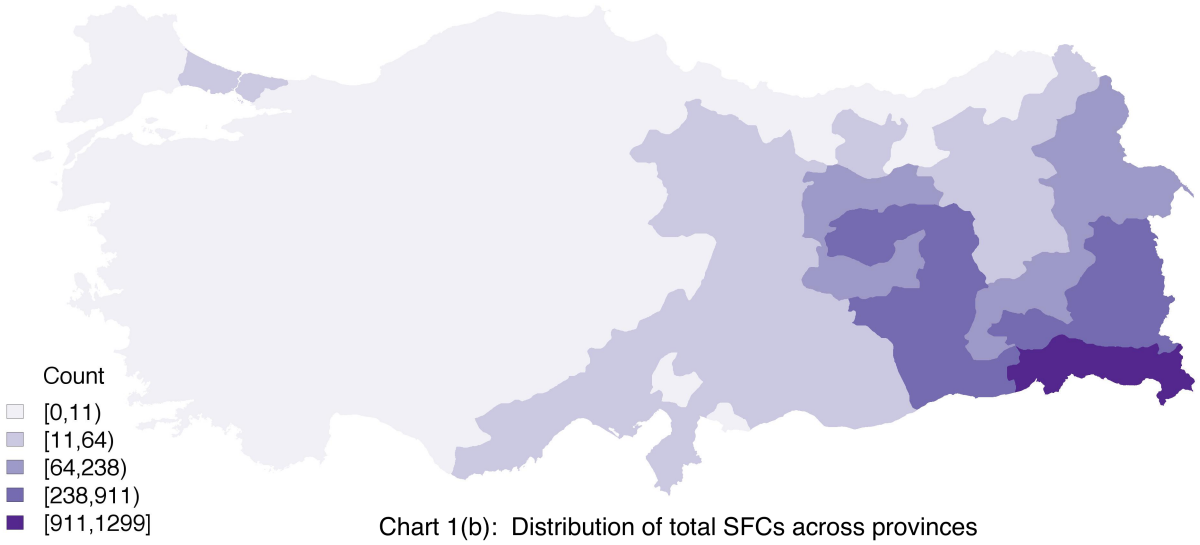


Chart 1(b): Distribution of total SFCs across provinces

disparity between the conflict zone and the rest of the country. The area has lost its economic and social appeal for business and people, and has come to be considered as exile by public employees like doctors and teachers who are subject to periodical appointments by the state.

3.2 The Health Sector in Turkey

Up until recent years, the health sector in Turkey has been almost entirely public. Private hospitals accounted for less than 3% of hospital beds across the country in 1990, 8% in 1999, and 15% in 2010. In other words, the state has been the biggest (and in less developed and rural areas, the only) employer and service provider in health. Consequently, state employment policies have almost completely determined the demand side of the labor market in medical professionals.

The state has been very influential on the supply side of the market as well by heavily regulating it with strict legal codes. The Turkish law (Official Gazette of the Republic of Turkey, 1928) states that in Turkey only medical professionals of Turkish nationality with a medical diploma officially recognized by the Turkish Ministry of Health can provide services to Turkish citizens. This regulation was relaxed in 2012 to allow private health institutions to employ foreign national doctors (Official Gazette of the Republic of Turkey, 2012). Note that this legal structure combined with the public nature of the sector almost completely limits the supply side of the medical labor market to domestic human resources.

The public nature of the sector is associated with its main problems as well. Turkey has always performed among the worst in financial and human health resources among OECD members (OECD, 2015). Another important problem in the sector has been the sharp geographical disparities in the allocation of available resources. While the developed urban centers of the West received the largest share in especially human resources, the East was left behind. In this study, we argue that the enduring civil conflict has been an important factor behind this disparity. By damaging the socioeconomic life and by creating security concerns the conflict has been driving away highly trained medical personnel from conflict areas, and as such has been contributing to the geographical disparities in the distribution of health resources across the country. Chart 2 plots the average number of specialist doctors across provinces in the 1964-2010 period. As can be seen clearly, Eastern and Southeastern provinces have the lowest numbers of specialist doctors.

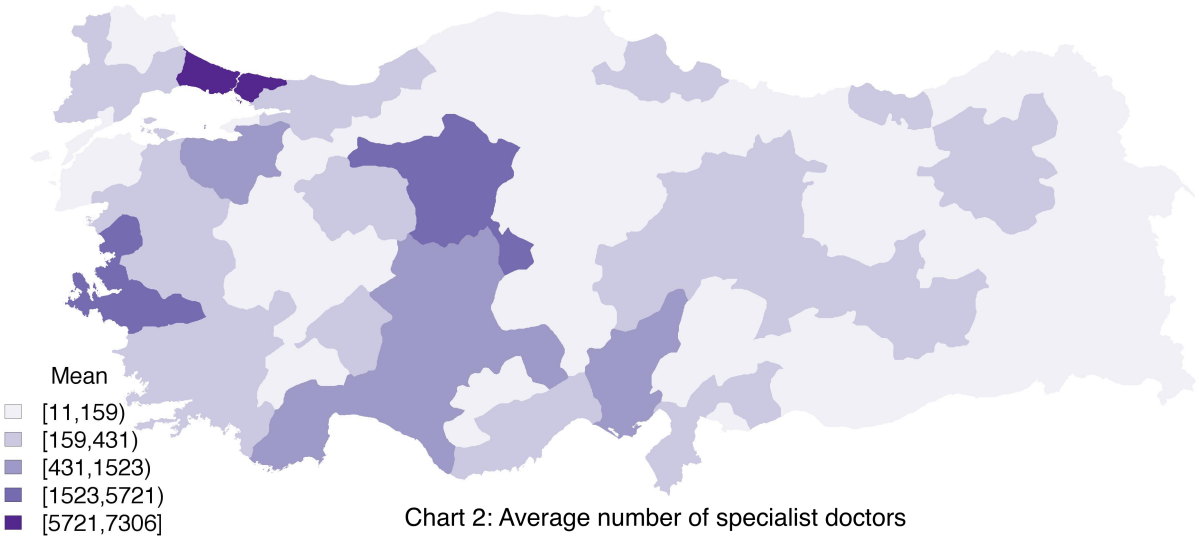


Chart 2: Average number of specialist doctors

Note that international medical aid organizations, like Red Cross, or Médecins Sans Frontières have never intervened in the conflict in Turkey. As we mentioned above, the Turkish law bans foreign nationals from providing health services to Turkish citizens in Turkey. We have contacted the Turkish Health Ministry and the Turkish Medical Association to inquire about the actual practice, and learnt that such institutions are allowed to provide medical services in Turkey only in cases of humanitarian crises like natural disasters, but even then they need permission from the Turkish Ministry of Internal Affairs and the Ministry of Health. Note that the conflict in Turkey has been a low intensity one, and as such it has never created humanitarian crisis situations like the conflicts in Rwanda or Somalia where public services and even the state collapsed completely. Consequently, it has not attracted the attention of international medical aid institutions. The only exception took place in 1996 when Médecins Sans Frontières applied formally together with the Turkish Medical Association of Doctors to conduct a vaccination and prenatal care campaign in southeastern Turkey. That application was turned down by the Ministry of Internal Affairs for reasons of national security.

4. THE DATA

In this study, we employ a novel database that includes the number of specialist and general practitioner doctors, dentists, nurses, midwives, and health technicians across provinces in Turkey in the 1964-2010 period. To construct this database we conducted a thorough study in the Turkish State Archives. We provide a detailed list of our sources in the References section. Our database also includes the yearly percentages of births unattended by health personnel for the 1964-1981 and 1993-2005 periods, age-zero group BCG vaccination rates for the 1994-2006 period, and the yearly number of open positions for doctors at public health institutions for the 2004-2012 period across provinces.

In order to measure the intensity of the conflict, we refer to the casualty database by Kıbrıs (2011; 2014; 2015). This is a unique data set on Turkish military and police force casualties (security force casualties-SFCs) that the Kurdish insurgency claimed since the beginning of armed attacks in 1984. The data set includes the date, and place of death for a total of 6851 SFCs. The number of SFCs provide our measure of conflict intensity across provinces. While SFCs do not correspond to total casualties, which is a commonly used measure of conflict intensity in the literature, we expect a high correlation between the two. In fact, the yearly aggregates are 98% correlated with the yearly total number of PKK attacks reported by the Turkish General Staff (Şener, 2010), and 96% correlated with the yearly total casualties reported by the Federation of American Scientists (www.fas.org). Other socioeconomic indicators included in our models are derived from the Turkish Institute of Statistics. Table 1 presents the descriptive statistics. Note that all our variables are measured at the aggregate province level employing data that had already been released in various other publications. Consequently, ethical approval is not required for our study.

5. THE ANALYSES

TABLE 1: Descriptive Statistics					
Variable	**Time span**	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Number of specialist doctors	1964-2003 2006-2010	341,15	1112	1	14437
Number of general practitioner doctors	1964-2003 2006-2010	306,45	766,97	5	9625
Number of dentists	1964-2003 2006-2010	133,64	440,4	1	5636
Number of nurses	1964-2003	477,13	989,59	4	10112
Number of midwives	1964-2003	309,34	370,12	4	3271
Number of health technicians	1964-2003	261,91	449,57	11	5377
Security force casualties in previous year	1964-2010	1,67	9,83	0	236
Population in ten thousands	1964-2010	73,55	104,29	0,51	1362,42
GDP per capita in constant prices	1975-2001	11408,98	6386,92	746,8	44889
Percentage of births unattended by medical personnel	1964-1981 1993-2006	18,24	17,53	0	100
BCG vaccination rates among new borns	1994-2006	75,82	20,89	2	100
Number of open MD positions at public health institutions	2004-2012	42,22	48,36	0	305
All variables are observed at the province level. Due to administrative changes the number of provinces changed over the years.					

5.1 Conflict and Availability of Medical Professionals

In our base model, the dependent variable is the number of medical professionals across provinces. We present the frequency distributions of our dependent variables in Chart A1 in the appendix. As the histograms clearly reveal, these are highly skewed, over-dispersed count variables which only take strictly positive integer values. Accordingly, we estimate the parameters of the following fixed effects negative binomial regression model:

$$E(Y_{i,t}) = \lambda_{i,t} = \exp(\alpha + \beta_1 C_{i,t-1} + \beta_2 X_{i,t} + \beta_3 T + \beta_4 P + u_{i,t})$$

where Y_{it} is the number of medical professionals in province i in year t. We analyze the number of specialist doctors, general practitioner doctors, dentists, midwives, nurses, health technicians and the total number of medical professionals respectively in the 1964-2010 period. $C_{i,t-1}$ is the number of security force casualties in province i in year (t-1); X_{it} is the population of province i in year t in ten thousands; T and P are vectors of year and province dummies controlling for time and province specific effects respectively. Population numbers allow us to control for the demand for medical professionals, and also for the size of the locality. We were also able to collect data on GDP per capita in constant prices across provinces for the 1975-2001 period. We also present the results we get when we include this covariate in the model (restricting the time period of our analyses accordingly).

Table 2 presents the results from the first set of models and Chart 3 visualizes them. For ease of reading we report the natural log of estimated parameters which corresponds to the *incidence rate ratio* and gives the multiplicative change in the dependent variable associated with a unit change in the control variable. The estimated incidence rate ratio for SFCs, for example, tells us that an additional SFC leads the number of specialist doctors to be multiplied by 0.992, or in other words, is associated with a 0.8% decline in the number of specialist doctors. We report the estimated average marginal effects in Table A1 in the appendix.

As the results demonstrate, except for health technicians, the conflict is significantly and negatively associated with the number of medical professionals across provinces. The association is more substantial for specialist doctors and dentists, whereas it is insignificant for health technicians. This is not a surprising pattern considering that specialists and dentists are the most specialized doctors with the most education among the professionals we consider whereas technicians are the least educated. As such, specialists and dentists are expected to be the most, and technicians the least mobile group.

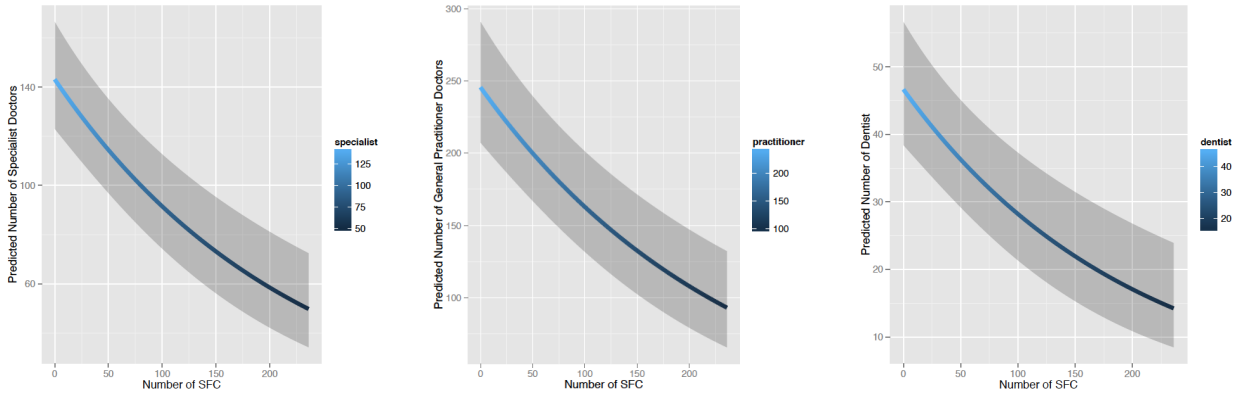
Table 2: Results of the negative binomial regressions - Base model Reported coefficients are incidence rate ratios						
Dependent variable: **Independent Variables**	**Number of specialist doctors**	**Number of specialist doctors**	**Number of general practitioner doctors**	**Number of general practitioner doctors**	**Number of dentists**	**Number of dentists**
Number of SFCs in previous year	0.992*** (-8.91)	0.997*** (-2.82)	0.996*** (-5.54)	0.998*** (-3.38)	0.995*** (-4.38)	0.998 (-1.40)
Population in ten thousands	0.999*** (-5.00)	0.999 (-1.59)	0.999*** (-5.92)	0.999 (-0.91)	1.0002* (1.77)	1.0007*** (5.02)
GDP per capita in constant prices		1.000*** (5.48)		1.000 (1.51)		1.000*** (6.88)
Province and year dummies	Not reported, available upon request.					
Number of observations	3175	1927	3177	1927	3171	1926
Log likelihood	-14545.79	-8207.10	-15238.75	-8963.21	-12592.02	-7702.03
AIC	29183.58	16474.21	30569.49	17986.42	25276.04	15464.07
BIC	29462.48	16641.12	30848.42	18153.33	25554.88	15630.97
***: significant at 1% level; **: significant at 5% level. z-values in parenthesis						

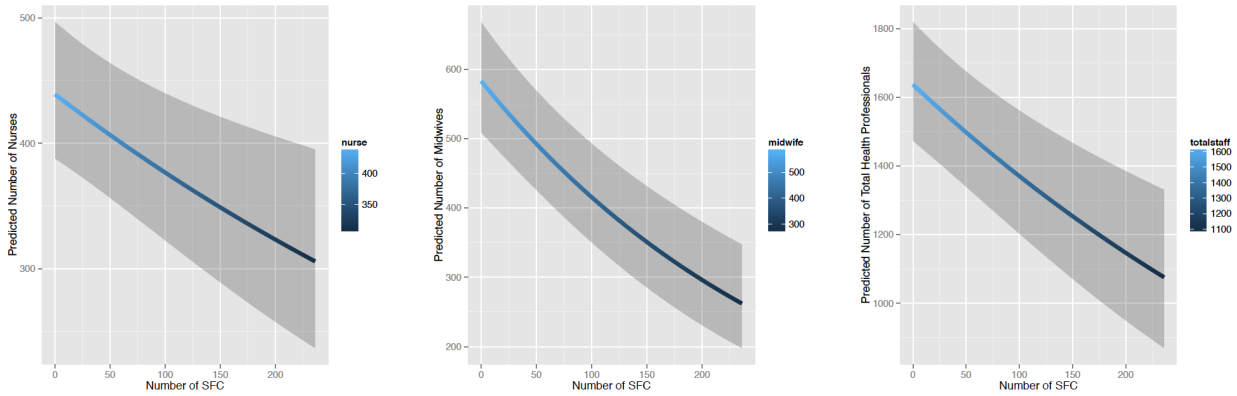
A look at the distribution of SFCs over the years and provinces reveals the magnitude of the impact more clearly. In 1993, the average number of SFCs in provinces with casualties was 26 with 12 provinces above this average. Based on the estimated coefficients, a province with 26 SFCs is expected to have 20% less specialist doctors, 10% less general practitioner doctors, 12% less dentists, 5% less nurses, and 10% less midwives in 1994 compared to similar size provinces with no casualties. These declines correspond to 38% less specialists, 20% less general practitioners, 25% less dentists, 11% less midwives in provinces with around 56 SFCs, which is only one standard deviation away from the average.

Table 2-continued: Results of the negative binomial regressions - Base model Reported coefficients are incidence rate ratios								
Dependent variable: **Independent Variables**	**Number of nurses**	**Number of nurses**	**Number of midwives**	**Number of midwives**	**Number of health technicians**	**Number of health technicians**	**Total number of health professionals**	**Total number of health professionals**
Number of SFCs in previous year	0.998*** (-2.62)	0.998*** (-2.78)	0.997*** (-5.94)	0.996*** (-5.88)	1.0003 (0.77)	1.0004 (1.07)	0.998*** (-2.95)	0.998*** (-3.12)
Population in ten thousands	1.0004*** (6.31)	1.0006*** (8.10)	1.0007**** (9.21)	1.0008*** (9.25)	0.999** (-2.37)	0.999*** (-4.11)	1.0002*** (2.64)	1.0002*** (3.06)
GDP per capita in constant prices		1.000*** (10.18)		1.000*** (8.29)		0.999 (-0.53)		1.000*** (7.54)
Province and year dummies	Not reported, available upon request.							
Number of observations	2693	1847	2693	1847	2692	1847	2682	1846
Log likelihood	-13771.7	-9515.3	-13797.8	-9395.1	-13045.9	-8759.8	-16702.3	-11.338.4
AIC	27623.4	19088.6	27675.6	18848.2	26171.8	17577.5	33484.6	22734.9
BIC	27859.3	19248.8	27911.5	19008.3	26407.7	17737.6	33720.4	22894.9
***: significant at 1% level; **: significant at 5% level. z-values in parenthesis								

We have also examined the predictive performance of our model by conducting twofold cross-validation tests. We have randomly set aside 20 percent of our observations, and fit the model

Chart 3: The predicted association between the number of health professionals and security force casualties





on the remaining 80 percent. Then we used the observations we had excluded as a test bed to see how accurately our model can predict them. Chart A2 in the appendix depicts the results. As can be seen the predicted values and the actual observations fit well .

Our results are also robust to alternative model specifications. There is an ongoing debate in the literature about the possible shortcomings of the nonlinear fixed effects estimators, most importantly the "incidental parameters problem" which jeopardizes the unbiasedness of estimates. We deal with this problem by employing the conditional fixed-effects negative binomial regression estimator by Hausman, Hall, and Griliches (1984) (as implemented in Stata via the "xtnbreg, fe" command). Their estimator avoids the incidental parameters problem by conditioning the likelihood function for each panel by the sum of the counts for that panel. Nonetheless, we also estimate the random effects specification of our model. The results, which are available upon request are almost identical. We also log transform our dependent variables and reestimate a linear version of our model with OLS. The results, which we present in Table A2 in the appendix, remain very similar. Finally, we reestimate our original negative binomial model with the inclusion of the lagged dependent variable. The results, which are available upon request, remain consistent.

5.2 Availability of Medical Personnel and Public Health

There is an extensive literature which clearly establishes the positive impact of the availability of medical professionals on public health. In a recent review of this literature Starfield,

Shi and Macinko (2007) reanalyze the results of recent studies conducted in the United States, and find that supply of primary care physicians is negatively associated with mortality rates. Similarly, Gulliford (2002) demonstrates that higher general practitioner supply dampens mortality rates in Great Britain. Shi (2012) reviews the literature on the association between the supply of primary care physicians and various health outcomes and concludes that increasing the supply of primary care physicians by one unit per 10,000 population might improve health outcomes by as much as 10.8%. Similarly, Shi et al. (2004) find that the supply of general practitioners is negatively associated with infant mortality and low birth weight. Pierard (2014) reaches a similar conclusion with Canadian data. Sakai et al. (2015) demonstrate the positive association in Japan between the supply of pediatricians and vaccination coverage in kids. Gai and Yan (2014) report a similar association between the supply of family physicians and influenza vaccination rates in the U.S.. Lavy et al. (1996) find out that an increase in the number of doctors in Ghana would reduce the height gap between a Ghanaian child and an American child. Recent studies also document the positive impact of physician availability on cancer detection (Gorey et al., 2010; Roetzheim et al., 2000) and survival rates (Sundmacher and Leonie, 2011; Ananthakrishnan et al., 2010).

In light of these results, we argue that the flight of medical personnel away from conflict areas is an important mechanism through which civil conflicts hurt public health. We have conducted some preliminary tests of this argument with our data as well. Specifically, we analyze whether and how the predicted numbers of health professionals we obtain from our base model are associated with the percentage of births unattended by medical personnel and BCG vaccination rates among new borns in Turkey across provinces and years. The analyses and the results which are presented in the appendix in Tables A3 and A4 support our argument and demonstrate that the supply of medical professionals, which we predict as a function of conflict intensity, is associated with improvements in public health indicators.

6. CARROTS AND STICKS: PAY THEM MORE OR OBLIGE THEM TO WORK

Over the years Turkish governments implemented certain policies to intervene in the health labor market to counteract the conflict's negative impact on physician availability, and to ameliorate the disparity across regions. In 1988, in response to increased PKK activity in the region, a state of emergency was declared in 13 provinces in the Southeast. It was then decided that public servants in those provinces were to be paid around 30% more compared to their colleagues in other parts of the country (Official Gazette of the Republic of Turkey, 1988). This policy remained in place until 2002 (some provinces regained normal status earlier in 1996). Another such interventionist policy is the mandatory service requirement for doctors that was implemented between 1982 and 1994, and from 2006 onwards (Official Gazette of the Republic of Turkey, 1981; 2005). The policy requires doctors to serve for two years in places they are appointed to by the state. The appointment is conducted randomly via a lottery. Every year (every two months after 2006) the Ministry of Health announces open positions for specialists and general practitioners. Doctors who have just graduated or who have just completed their specialization declare their preferred provinces, and get assigned to their preferred location if the number of doctors who prefer that province does not exceed the number open of positions in the province. For highly demanded provinces a lottery is held and those who fail to attain their primary choice are then randomly assigned to other open positions. Note that because everyone prefers the western metropolitan areas, this procedure basically amounts to randomly assigning doctors to open positions, a great number of which are in the conflict areas.

To analyze whether these two policies have been successful, we modify our original model to include an additional pay policy dummy ($D1_{i,t}$) and a mandatory service requirement dummy ($D2_{i,t}$). These dummies take on the value 1 in those provinces and years these policies were in effect. We also include an interaction variable between casualties and the mandatory service requirement dummy to identify whether the mandatory service requirement had a differential

association with respect to conflict intensity. In other words, we estimate the following count model:

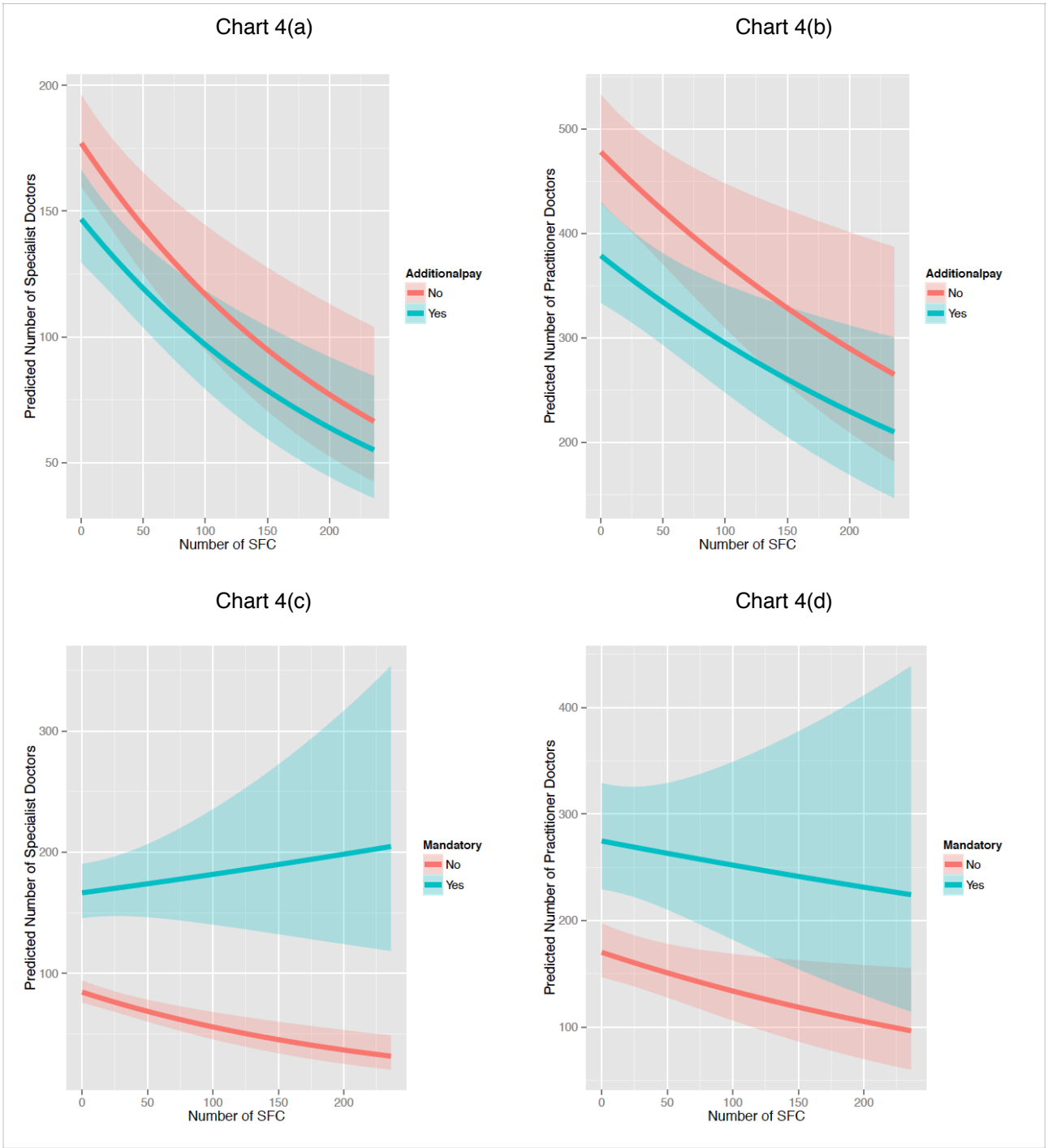
$$E(Y_{i,t}) = \lambda_{i,t} = \exp(\alpha + \beta_1 C_{i,t-1} + \beta_2 X_{i,t} + \beta_3 D1_{i,t} + \beta_4 D2_{i,t} + \beta_5 D2_{i,t} * C_{i,t-1} + \beta_6 T + \beta_7 P + u_{i,t})$$

Table 3 presents the results, and Charts 4(a)-4(d) visualize them.

Table 3: Results of the fixed effects negative binomial regressions on the number of medical personnel - Policy analyses
Reported coefficients are incidence rate ratios.

Dependent variable:	**Number of specialist doctors**	**Number of general practitioner doctors**
Independent Variables		
Number of SFCs in previous year	0.995*** (-4.42)	0.997** (-2.33)
Population in ten thousands	0.999*** (-6.72)	0.999* (-1.87)
Additional pay policy dummy	0.829*** (-5.37)	0.807*** (-4.76)
Mandatory service dummy	1.968*** (16.35)	1.614*** (9.11)
Interaction between mandatory service and casualties	1.005*** (4.03)	1.002 (1.06)
Year and province dummies	not reported, available upon request	
Number of observations	3175	3177
Log likelihood	-14821	-16653
AIC	29901	33564
BIC	30683	34347

***: significant at 1% level; **: significant at 5% level. z-values in parentheses.



Interestingly, the results indicate a significant drop in numbers in places where the additional pay policy was in effect. This drop is most probably due to the fact that the policy was employed only in provinces under the state of emergency, and that the state of emergency was declared when and where the armed conflict was really intense. In other words, the policy dummy is capturing the impact of high conflict intensity. Unfortunately we can only observe the net impact of the additional pay policy and high conflict intensity as the geographical and temporal overlap disables us from

separating one from the other. This overlap also prevents us from analyzing the differential association the additional pay policy may have with medical personnel availability in conflict areas. The interaction variable between the SFCs and additional pay policy dummy turns out to be 96% correlated with the SFC series and thus, cannot be included in the model without causing severe multicollinearity. Nonetheless, even though we are not able to decipher the exact association between the additional pay policy and medical personnel availability, the results clearly reveal that the 30% additional pay was not enough to ameliorate the situation in the state of emergency zone.

Such identification problems are less prevalent when analyzing whether and how the mandatory service requirement policy is associated with physician availability. The estimated coefficients indicate that the mandatory service requirement is associated with almost a two-fold increase in the number of doctors, and the magnitude of the association is even greater in conflict areas. Note that the widening of the error bands in Charts 4(c) and (d) towards the right is due to having fewer observations with such high casualties during the years mandatory service requirement was in place.

Next we explore whether the increase in doctor counts that comes with the mandatory service requirement brings about an improvement in public health in conflict areas. To do that we focus our attention to the 2005-2006 period when the mandatory service requirement policy was reintroduced, and estimate the following Tobit regression model

$$Z_{i,t} = \alpha + \beta_1 C_{i,t-1} + \beta_2 X_{i,t} + \beta_3 D2_t + \beta_4 D2_{i,t} * C_{i,t-1} + \beta_5 P + u_{i,t}$$

where $Z_{i,t}$ will be the percentage of births unattended by medical personnel, and BCG vaccination rates among new borns in province i, in year t respectively. D2 is the policy dummy and takes on the value 1 for year 2006 when the mandatory service requirement was reintroduced. We also estimate an alternative model in which we include a dummy for emergency zone status to differentiate those provinces that have been at the heart of the conflict and to account for high levels of violence in the past. Note that because emergency zone status is a province level fixed effect, we

control for other province level unobservables with random effects in this alternative specification. Table 4 demonstrates how the mandatory service requirement policy counteracts the negative effects conflict inflicts upon public health in conflict areas when it is implemented.

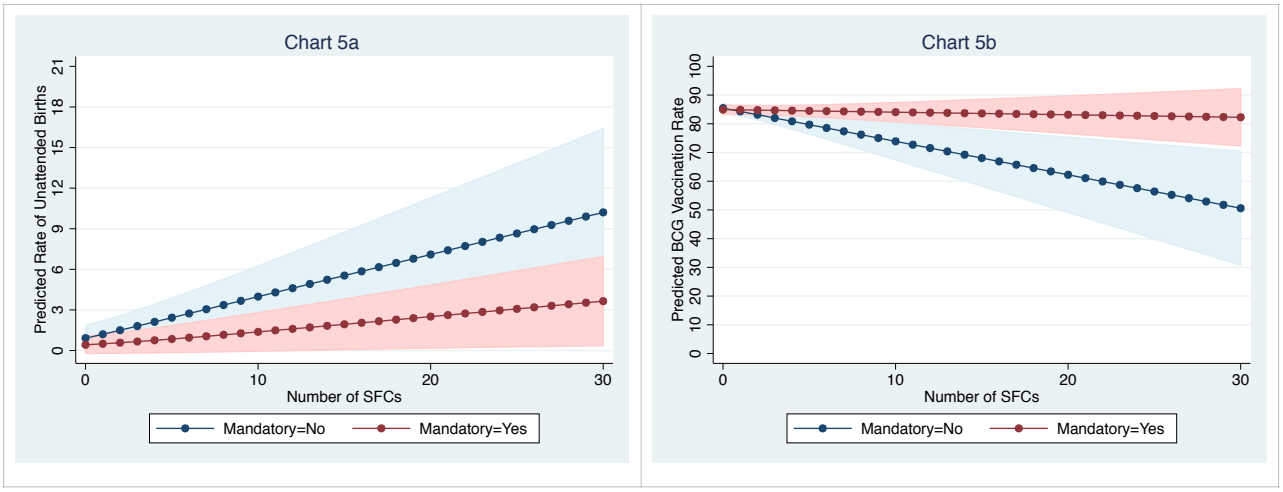
Table 4: Results of the Tobit regressions on public health indicators - Policy analyses

	Fixed effects specification	Random effects specification	Fixed effects specification	Random effects specification
Dependent variable:	**Percentage of births unattended by medical personnel**	**Percentage of births unattended by medical personnel**	**BCG vaccination rate among new borns**	**BCG vaccination rate among new borns**
Independent Variables				
Number of SFCs in previous year	0.311*** (3.00)	0.338** (2.44)	-2.58*** (-5.30)	-1.51*** (-3.67)
Population in ten thousands	-0.003 (-0.08)	-0.002 (-0.38)	-0.029 (-0.19)	0.013** (2.48)
Mandatory service policy dummy	-0.644*** (-4.96)	-0.643*** (3.68)	-0.677 (-1.12)	-0.581 (-0.70)
Interaction between mandatory service policy dummy and the number of SFCs in previous year	-0.197*** (-3.15)	-0.209** (-2.45)	1.791*** (6.10)	1.249*** (3.92)
Emergency zone dummy		15.329*** (8.01)		3.81 (1.51)
Standard error for province level random effects		0.969		0.546
Log likelihood	-179.65	-402.88	-427.12	-535.42
AIC	529.31	821.76	1026.24	1086.84
BIC	791.75	846.46	1291.77	1111.54
Number of observations: 162				
Hausman test H_0: Difference in coefficients between the fixed and random effects specifications is not systematic.				
Chi^2	-0.11		12.99	
(p-value)	Hausman test is not well-defined.		(0.01)	

***: significant at 1% level; **: significant at 5% level. z-values in parenthesis.

While each additional SFC is associated with a 0.31 point increase in the percentage of births unattended by medical personnel, the introduction of the policy decreases the percentage to 0.11

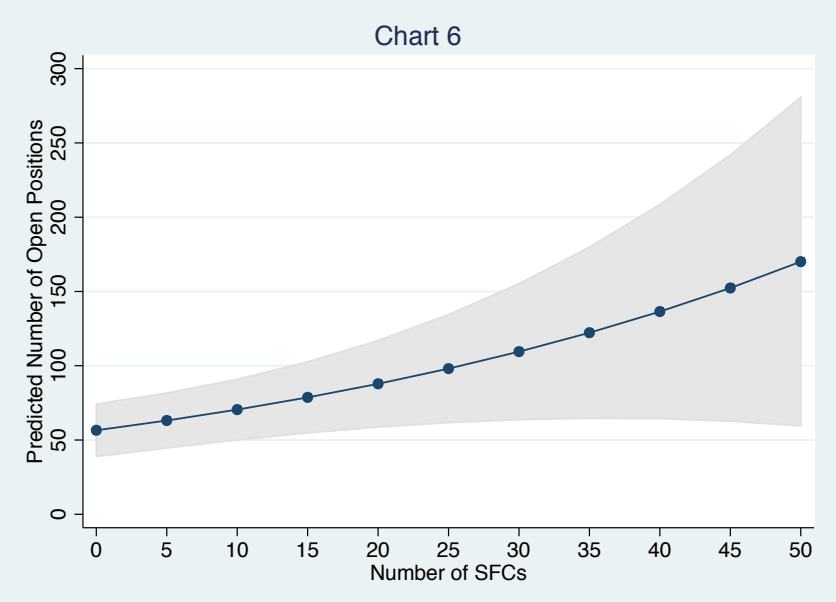
points. Similarly, while each additional SFC is associated with a 2.58 points decrease in the BCG vaccination rates among new borns, with the introduction of the policy, the damage goes down to 0.79 points. Charts 5a and 5b visualize these results.



Further evidence of how medical personnel availability is negatively associated with conflict intensity and positively associated with the mandatory service requirement policy comes from a closer look at the open position announcements by the Turkish Ministry of Health. We estimate a negative binomial fixed effects model to analyze the association between the yearly number of open positions and conflict intensity across provinces over the 2007-2011 period. We control for per capita number of general practitioner doctors in the previous year to account for the demand for doctors; the number of one-year-lagged SFCs to account for recent episodes of violence; and the total amount of bank deposits to account for economic development. We also estimate an alternative specification with random effects in which we include a dummy for emergency zone status to account for high levels of violence in the past. The results are presented in Table 5.

Table 5: Results of the negative binomial regression on the number of open positions Reported coefficients are incidence rate ratios.		
	Fixed effects specification	**Random effects specification**
Dependent variable:	**Yearly total number of open positions**	
Independent Variables		
Number of SF casualties in previous year	1.022*** (2.69)	1.022*** (3.08)
Number of practitioners per ten thousand inhabitants in previous year	1.001 (0.96)	0.999 (-0.75)
Emergency zone dummy		1.423** (2.33)
Bank deposits	1.000 (1.18)	0.999 (-1.20)
Standard error for province level random effects		1,453
Log likelihood	-1696	-2221
AIC	3401.84	4456.04
BIC	3418.48	4485.25
Hausman test H_0: Difference in coefficients between the fixed and random effects specifications is not systematic.		
Chi^2 (p-value)	-164.33 Hausman test is not well-defined.	
Number of observations: 480	Number of groups: 80	Observations per group: 6
***: significant at 1% level; **: significant at 5% level. z-values in parentheses.		

The fixed and random effects specifications yield very similar results and indicate that compared to other provinces, each year a significantly higher number of open positions are announced in provinces with recent and past casualties.



Note that if the mandatory service requirement is effective in counteracting the flight of doctors from conflict areas, then, with the reinstatement of the policy in 2006, we should see a decrease in the number of open positions in those areas. Table 6 presents the results when, we focus our attention to the 2005-2006 period and estimate the above fixed and random effects regressions on the number of open positions including a policy dummy to account for the policy change in 2006 and its interaction with SF casualties. Chart 7 visualizes these results. The results indicate that the policy dampens the positive association between conflict intensity and open positions.

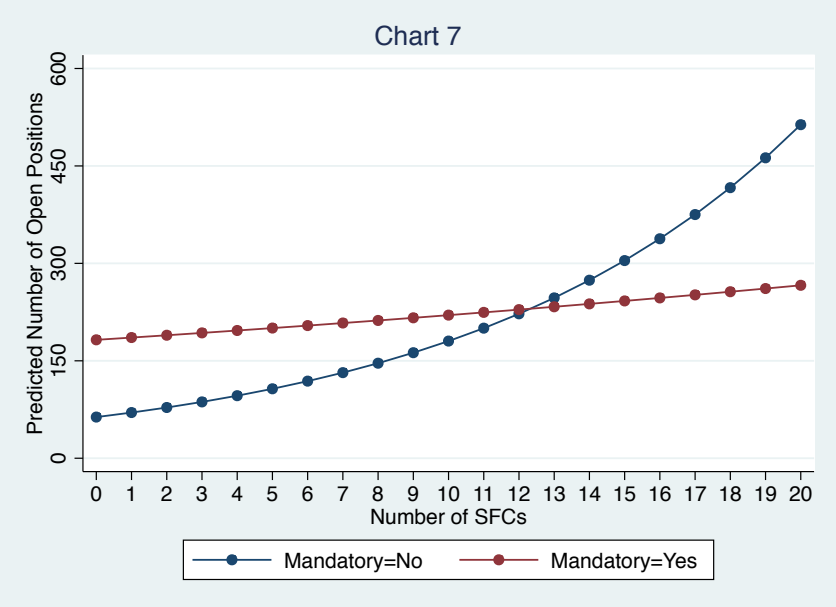


Table 6: Results of the negative binomial regression on the number of open positions Reported coefficients are incidence rate ratios.		
	Fixed effects specification	**Random effects specification**
Dependent variable:	**Yearly total number of open positions**	
Independent Variables		
Number of SF casualties in previous year	1.19** (3.76)	1.11** (2.28)
Population in ten thousands	1.005 (0.92)	1.006 (1.40)
Bank deposits	0.999 (-0.96)	0.999 (-1.56)
Emergency zone status		4.64*** (4.21)
Mandatory service policy dummy	3.37*** (7.90)	2.88*** (6.40)
Interaction between mandatory service policy dummy and the number of SFCs in previous year	0.874*** (-3.96)	0.918*** (-2.61)
Standard error for province level random effects		0.547
Log likelihood	-202	-584
AIC	417.64	1187.79
BIC	435.38	1215.47
Hausman test H_0: Difference in coefficients between the fixed and random effects specifications is not systematic.		
Chi^2 (p-value)	16.31 (0.006)	
Number of observations:160	Number of groups: 80	Observations per group:
***: significant at 1% level; **: significant at 5% level. z-values in parentheses.		

7. CONCLUSION

This study demonstrates how the enduring civil conflict in Turkey has been driving away medical personnel from conflict areas, and by doing so, draws attention to an important, yet never analyzed before mechanism through which civil conflicts exert their long-term negative influences on public health. We emphasize that there are also other mechanisms, like the destruction of infrastructure and the lack of financial resources which in many cases operate simultaneously, and

which, compared to the flight of medical professionals, might have larger impacts on public health. Nevertheless, the lack of empirical studies on those other possible mechanisms prevents us from conducting such comparisons. Future research is needed to evaluate the different simultaneously existing mechanisms, which might also have interactive effects. The destruction of infrastructure, for example, is likely to feed the flight of medical professionals by damaging practice conditions and post-graduate training possibilities for them. This is especially true for specialist doctors since they require advanced hospital facilities. For similar reasons, we also expect the flight of medical personnel to self-perpetuate because medical practice is a process of life-time learning which requires a lively work environment where medical professionals can consult and learn from each other.

Our work is also related to the literature on the international migration of physicians from developing countries to rich Western nations. The works in this literature cite low-pay, insufficient postgraduate training opportunities, general economic and social conditions, and poor practice conditions as the main reasons of physician migration from developing countries (Hagopian et al., 2005). All of these reasons are valid for within-country migration of medical personnel as well, especially in countries with substantial geographical disparities in development. Note that civil conflicts create most of these reasons. Moreover they add security concerns to the list of reasons for migration.

Our contribution extends to policy development as well. We assess the effectiveness of two policy measures that Turkish governments implemented over the years to intervene in the medical labor market to offset the disparity between the conflict zone and other parts of the country. The first policy amounted to paying about 30% more to doctors who serve in high conflict areas. Similar policies have been employed by developing countries like Ghana, Nigeria, and Kenya against the brain-drain they have been experiencing in their health sectors (Hagopian et al., 2005; Physicians for Human Rights, 2003). It turns out that in the Turkish case 30% more did not lead to an

improvement. An interesting question is how much more the government would have to pay the medical personnel to stop the flight, and whether such payments would have been feasible. We know from the experiences of sub-Saharan African countries that budgetary difficulties may lead to partial or insufficient implementation of such policies (Physicians for Human Rights, 2003). The second policy that we analyzed is the mandatory service requirement which is still in place today in Turkey for doctors. Again, we see similar approaches in international migration cases. Ghana, for example had a program that required medical school graduates to serve for 5 years before emigration or else pay back the cost of their education. The literature argues that policies that create barriers to flight serve as "bonding" strategies which give people time to bond with the location (Hagopian et al., 2005). In time young graduates get established in their posts, start families and settle. And as they do so they become less likely to migrate, especially those highly educated people for whom migration is more of a household decision. According to our results the mandatory service requirement policy has been much more effective in boosting the number of doctors in conflict areas and thus, in counteracting the damage on public health. Nevertheless, it fails to fully compensate for the negative association between the conflict and the supply of doctors. It seems neither carrots nor sticks yield stellar results on their own.

8. APPENDIX

The appendix is online at http://myweb.sabanciuniv.edu/akibris/files/2015/11/Appendix.pdf

[INSERT LINK TO ONLINE FILE]

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